A Microfluidic Platform for Isolation and Manipulation of Mechanotyped Cells

Todd Sulchek
Associate Professor of Mechanical Engineering
Georgia Tech

Abstract: The mechanical properties of cells seem to adapt to better perform certain functions such as migration through tissues. We present our work developing microfluidic cell isolation and manipulation systems that are responsive to cell mechanical properties. Microfluidic channels are designed that reposition flowing cells in proportion to important biomechanical properties of stiffness, size, and adhesion. The repositioned cells can then be collected at the outlets. We will demonstrate three examples of how this sorting process can be used to collect important subsets of cells, including: invasive ovarian cancer cells, drug resistant leukemia cells, and purer stem cell cultures. The sorting platforms can be helpful to address cell heterogeneity that complicate downstream detection and use. We also evaluate some important effects of fast (sub millisecond) compressions on cells, including the enhanced delivery of important reagents into cell interiors.

Bio: Todd Sulchek is an Associate Professor of Mechanical Engineering and conducts fundamental and applied research in the field of biomechanics. His research program focuses on creating new micro-technologies to apply to questions in cellular mechanics and adhesion. He joined Georgia Tech in 2008 as an Assistant Professor of Mechanical Engineering. Dr. Sulchek also holds program faculty positions in Bioengineering and Biomedical Engineering. Prior to Georgia Tech, he was a Postdoctoral Researcher and Staff Scientist at Lawrence Livermore National Laboratory. Dr. Sulchek graduated with his PhD in Applied Physics from Stanford University. He is a recipient of the NSF CAREER award, the CETL/BP Junior Faculty Teaching Excellence Award, the Lockheed Inspirational Young Faculty award, 2012 Petit Institute Above and Beyond Award, Class of 1940 Course Survey Teaching Effectiveness Award, and is a Woodruff Faculty Fellow. Over his research career he has published 74 journal papers and has filed or been issued 12 patents.